Advant® OCS
with Master software

EXCOM™

User's Guide

Use of **DANGER**, **WARNING**, **CAUTION**, and **NOTE**

This publication includes, **DANGER**, **WARNING**, **CAUTION**, and **NOTE** information where appropriate to point out safety related or other important information.

DANGER	Hazards which could result in severe personal injury or death
WARNING	Hazards which could result in personal injury
CAUTION	Hazards which could result in equipment or property damage
NOTE	Alerts user to pertinent facts and conditions

Although **DANGER** and **WARNING** hazards are related to personal injury, and **CAUTION** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **DANGER**, **WARNING**, and **CAUTION** notices.

TRADEMARKS

Master, MasterPiece, MasterView, MasterAid, and SuperView are registered trademarks of ABB Asea Brown Boveri Ltd. Switzerland

MasterNet, MasterBus, and MasterBatch are trademarks of ABB Asea Brown Boveri Ltd. Switzerland

Advant, AdvaCommand, AdvaInform, AdvaBuild, AdvaControl, AdvaBatch and AdvaTalk are registered trademarks of ABB Process Automation Corp. USA

NOTICE

The information in this document is subject to change without notice and should not be construed as a commitment by ABB Automation AB. ABB Automation AB assumes no responsibility for any errors that may appear in this document.

In no event shall ABB Automation AB be liable for direct, indirect, special, incidental or consequential damages of any nature or kind arising from the use of this document, nor shall ABB Automation AB be liable for incidental or consequential damages arising from use of any software or hardware described in this document.

This document and parts thereof must not be reproduced or copied without ABB Automation AB's written permission, and the contents thereof must not be imparted to a third party nor be used for any unauthorized purpose.

The software described in this document is furnished under a license and may be used, copied, or disclosed only in accordance with the terms of such license.

Copyright © ABB Automation AB 1996

TABLE OF CONTENTS

Chapter 1 - Introduction

1.1 General Information 1-1
1.2 Equipment Requirements 1-1
1.3 Manual Organization 1-2
1.4 Conventions 1-3
1.5 Related Documentation 1-3
1.6 Release History 1-3
1.7 Terminology 1-4
1.8 Product Overview 1-5
1.9 User Interface 1-7

Chapter 2 - Installation

2.1 Site Planning Environment 2-1
2.2 Setup 2-1
  2.2.1 MasterPiece 200/1, MasterView 800/1 or MasterGate 230/1 2-1
    2.2.1.1 Data Base Element for EXCOM 2-1
    2.2.1.2 DSCA 114 and DSTC 120 2-3
    2.2.1.3 Short Distance Modem 2-4
  2.2.2 Advant Controller 410 2-5
    2.2.2.1 Data Base Element for RS-232-C 2-5
    2.2.2.2 Data Base Element for EXCOM 2-7
    2.2.2.3 Communication Submodule CI531 2-9
  2.2.3 Advant Controller 450 2-11
    2.2.3.1 Data Base Element for RS-232-C 2-11
    2.2.3.2 Data Base Element for EXCOM 2-13
    2.2.3.3 Communication Submodule CI531 2-15
    2.2.3.4 Submodule Carriers 2-15
2.3 Shutdown Procedures 2-16
2.4 Start-up Procedure 2-17
2.5 Product Verification 2-17

Chapter 3 - Configuration/Application Building

3.1 Design Considerations 3-1
  3.1.1 General 3-1
  3.1.2 Syntax of Message 3-1
  3.1.3 Header 3-2
  3.1.4 Data Part 3-3
  3.1.5 Message with Checksum 3-4

CONTENTS (continued)

3.1.6 Data Base Files ... 3-5
3.1.6.1 DAT - Data Exchange File ... 3-5
3.1.6.2 DI - Digital Input File ... 3-7
3.1.6.3 AI - Analog Input File ... 3-8
3.1.6.4 Analog Output File ... 3-9
3.2 Capacity and Performance ... 3-9
3.3 Application Start-up ... 3-9
3.3.1 ABB Master Station Address ... 3-9
3.3.2 File Codes ... 3-10
3.3.3 Record Number ... 3-10
3.3.4 Data Sets ... 3-10
3.3.5 Symbolic Names ... 3-10
3.4 Tutorial ... 3-10
3.5 Application Procedures ... 3-10
3.5.1 Command and Reply Messages ... 3-10
3.5.1.1 Translate Symbol ... 3-11
3.5.1.2 Read File ... 3-12
3.5.1.3 Read Data Set ... 3-13
3.5.1.4 Write File ... 3-13
3.5.1.5 Write Data Set ... 3-14
3.6 Configuration/Application Building Menus ... 3-15

Chapter 4 - Runtime Operation

4.1 Product Operation ... 4-1
4.2 Operating Overview ... 4-1
4.3 Runtime Tutorial ... 4-1
4.4 Operating Instructions ... 4-1
4.5 Runtime Operation Menus ... 4-1

Chapter 5 - Maintenance

5.1 Preventive Maintenance ... 5-1
5.2 Hardware Indicators ... 5-1
5.3 Error Messages ... 5-1
5.3.1 Summary of the EXCOM Protocol Error Handling ... 5-2
5.3.2 Flow Control ... 5-2
5.4 Fault Finding and User Repair ... 5-3

Appendix A - ASCII Value Table

A.1 ASCII Value Table ... A-1

Chapter 1 Introduction

1.1 General Information

This manual is intended for the system programmer responsible for implementing EXCOM in an external system and for the user of the EXCOM function.

1.2 Equipment Requirements

The EXCOM function provides communication between external computers and the Controllers. EXCOM lets the external computer read from, and write to, the Data Base, using simple commands and a low cost asynchronous serial communication link. The communication protocol is easily implemented in any external computer, using normal basic input/output facilities.

Advant Controller 410/450 communicates with the external computer via the asynchronous communication module CI531.

Table 1-1. Asynchronous Communication Module CI531 Data

Function	Characteristics
Communication mode fixed master - slave relationship with the external computer as master	
Protocol elements	Commands and replies
Code	7 - bit ASCII
Maximum message length	326 characters
Error control	Characterwise parity and (optionally) a modulo 256 checksum
Commands	- Read process signal data of type AO, AI, DI or DO - Read/write data exchange file, DAT and DataSet, DSD - Translate symbolic names to numerical reference
Flow control	XON/XOFF
Interface	V.24 / RS-232-C
Transmission mode	Asynchronous, full duplex
Number of data bits	7 or 8

Table 1-1. Asynchronous Communication Module CI531 Data

Function	Characteristics
Parity	None, even, space or mark
Number of stop bits	1, 1.5, 2
Transmission speed	150, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps

1.3 Manual Organization

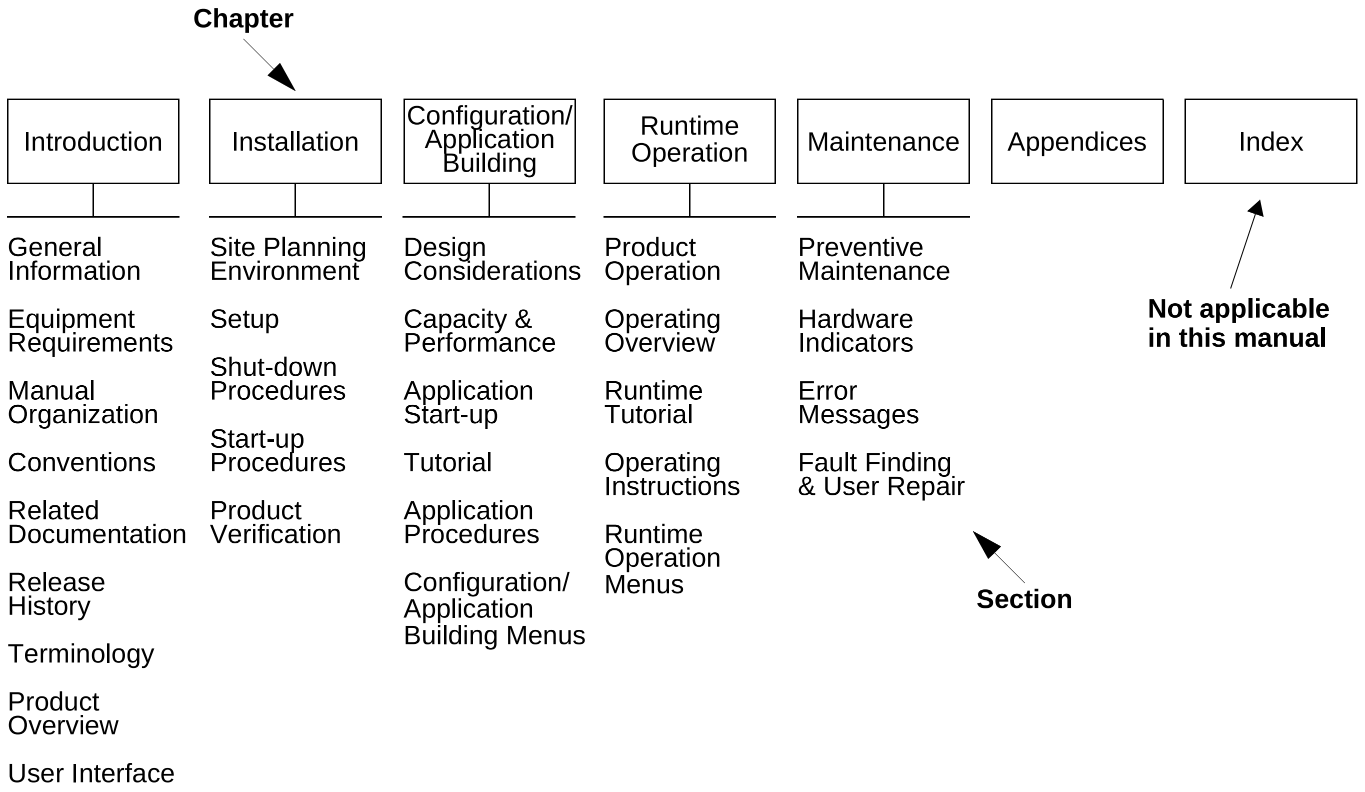


Figure 1-1. Manual Organization

1.4 Conventions

The Advant Controller 410/450 and MasterPiece 200/1 are referred to as Controller in this document.

AI, AO, DI and DO files are referred to as process data files.

1.5 Related Documentation

The following is a list of related documents.

Table 1-2. Related Documentation

Document Name
*Advant Controller 410 - User's Guid*e
Advant Controller 450 - User's Guide
Advant Controller 410/450 Configuration and Programming
Advant Controller 410/450 Series Data Base Elements Ref. Manual
MasterGate 230/1 - Technical Description

1.6 Release History

The EXCOM protocol and communication link is implemented in a number of pieces of ABB Master process control equipment. The first release of EXCOM was with the MasterPiece 2X0 and MasterGate 210 versions and, in the mid-80s, with the MasterPiece 200/1 version.

The ABB Advant Controller 410/450 also supports the EXCOM protocol. The ABB Advant Controller 410/450 version of EXCOM is compatible to previous versions of EXCOM on the protocol level. The only difference is that the newer version features new hardware with a slightly different communication speed capability.

1.7 Terminology

The following terminology is used in this manual:

EXCOM	EXternal COMmunication.
DSC	DataSet Communication
DSD	DataSet Definitions
DAT	Data Exchange file
AI	Analog Input
AO	Analog Output
DI	Digital Input
DO	Digital Output
AC	Advant Controller
AS	Advant Station
MP	MasterPiece
MG	MasterGate
MB	MasterBus
MMC	Man-Machine Communication
bps	bit per second

V.24/RS-232-C CCITT/EIA standard for interface description of asynchronous data communication, see Figure 1-2 and Figure 1-3.

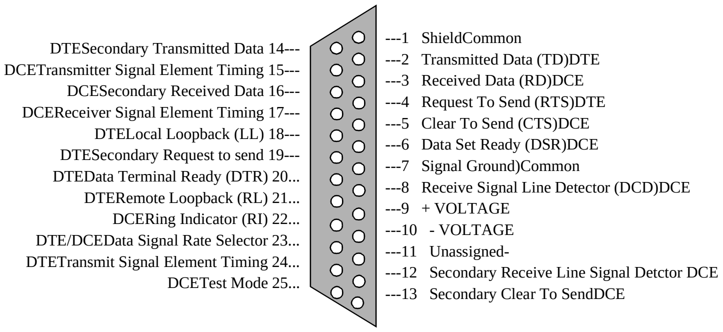

DTESecondary Transmitted Data 14---
DCETransmitter Signal Element Timing 15---
DCESecondary Received Data 16---
DCEReceiver Signal Element Timing 17---
DTELocal Loopback (LL) 18---
DTESecondary Request to send 19---
DTEData Terminal Ready (DTR) 20...
DTERemote Loopback (RL) 21...
DCERing Indicator (RI) 22...
DTE/DCEData Signal Rate Selector 23...
DTETransmit Signal Element Timing 24...
DCETest Mode 25...
---1 ShieldCommon
---2 Transmitted Data (TD)DTE
---3 Received Data (RD)DCE
---4 Request To Send (RTS)DTE
---5 Clear To Send (CTS)DCE
---6 Data Set Ready (DSR)DCE
---7 Signal Ground)Common
---8 Receive Signal Line Detector (DCD)DCE
---9 + VOLTAGE
---10 - VOLTAGE
---11 Unassigned-
---12 Secondary Receive Line Signal Detctor DCE
---13 Secondary Clear To SendDCE

Figure 1-2. V24/RS-232-C 25-Pin Contact

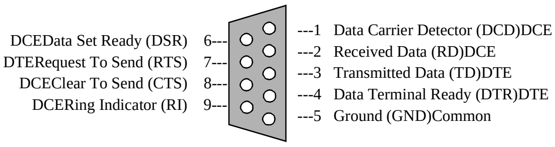

DCEData Set Ready (DSR) 6---
DTERequest To Send (RTS) 7---
DCEClear To Send (CTS) 8---
DCERing Indicator (RI) 9---
---1 Data Carrier Detector (DCD)DCE
---2 Received Data (RD)DCE
---3 Transmitted Data (TD)DTE
---4 Data Terminal Ready (DTR)DTE
---5 Ground (GND)Common

Figure 1-3. V24/RS-232-C Nine-Pin Contact

1.8 Product Overview

Using EXCOM, external computers can read and write data in the Controller Data Base, using simple commands and a low-cost asynchronous RS-232-C communication link. You can connect an external computer directly to the Controller (several if necessary). It can access all nodes within the Control Network that can be reached from the Controller via the network. The following figure, Figure 1-4, shows some typical examples.

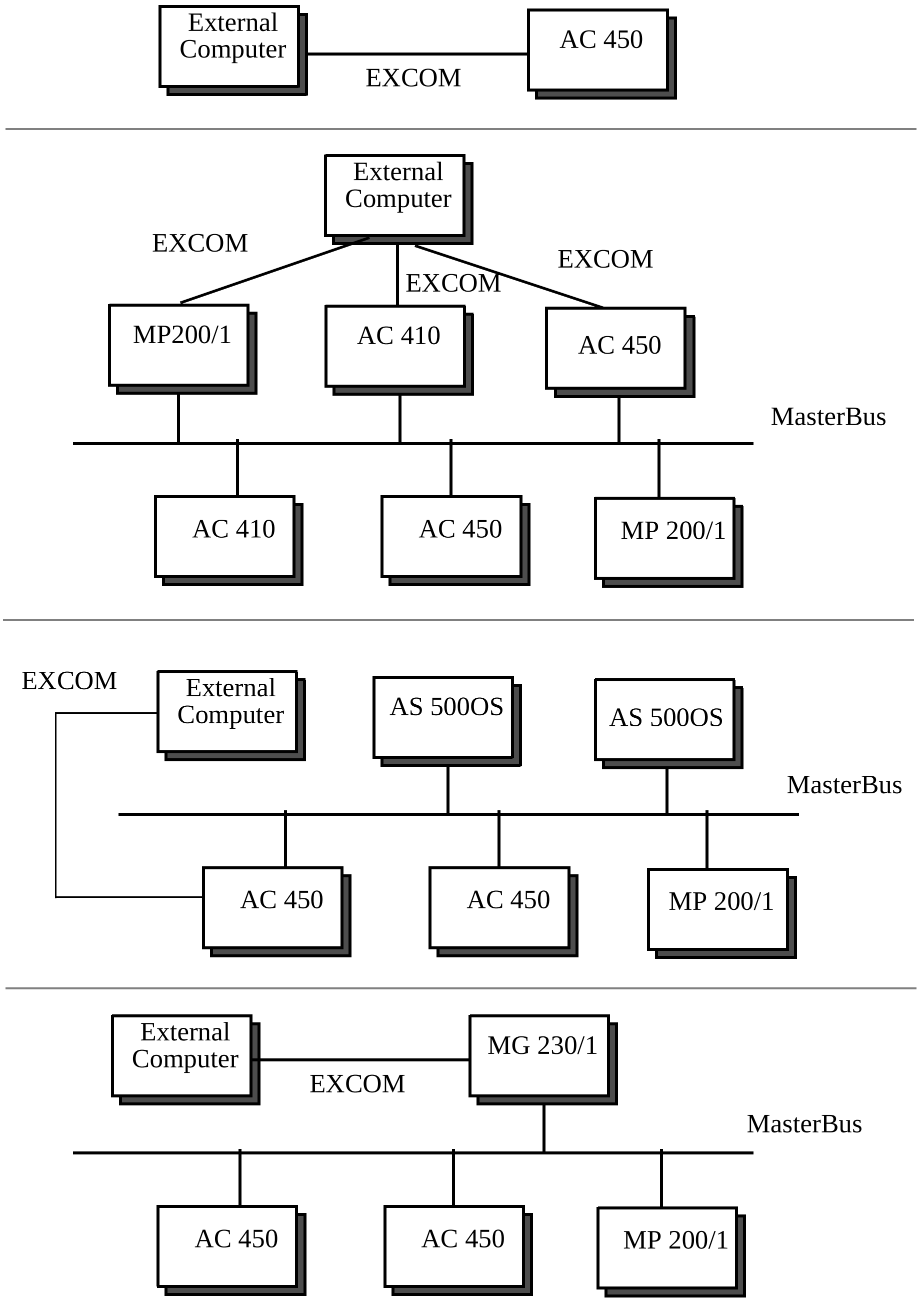


Figure 1-4. EXCOM Configuration

1.9 User Interface

The following figure shows the data flow between an external computer and a Controller.

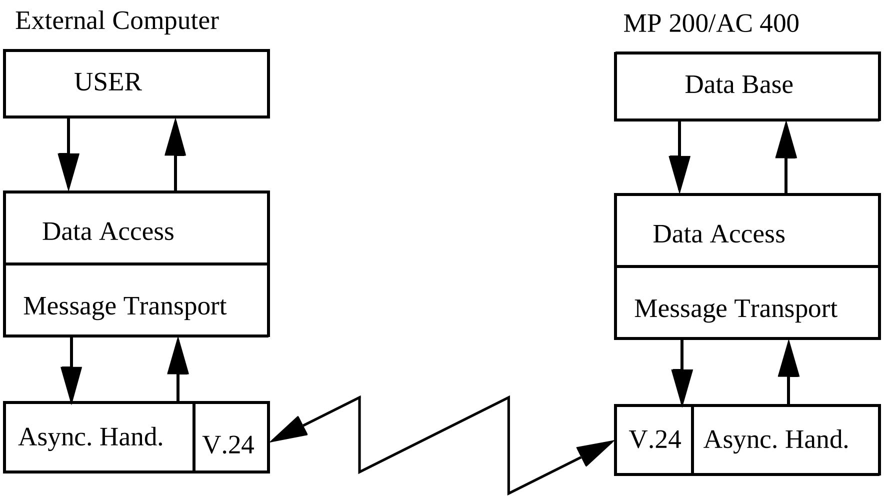


Figure 1-5. Data Flow between an External Computer and the Controller

Between an external computer and a Controller system, instructions and data are exchanged by means of an asynchronous handler and a standard V.24 (RS-232-C) signal interface.

The Data Base Elements for configuring the asynchronous communication link in the Controller are:

•	CI531	CI531 device file (communication module CI531)
•	XCOM_1 and XCOM_2	RS- 232-C characteristics (communication speed, parity a.s.o)

Data in the Controller are organized in files in a Data Base. The files accessible via EXCOM are:

•	DAT	Data Exchange file
•	DSD	Data Set Description file
•	AI	Analog Input file
•	AO	Analog Output file
•	DI	Digital Input file
•	DO	Digital Output file

AI, AO, DI and DO files are referred to as process data files.

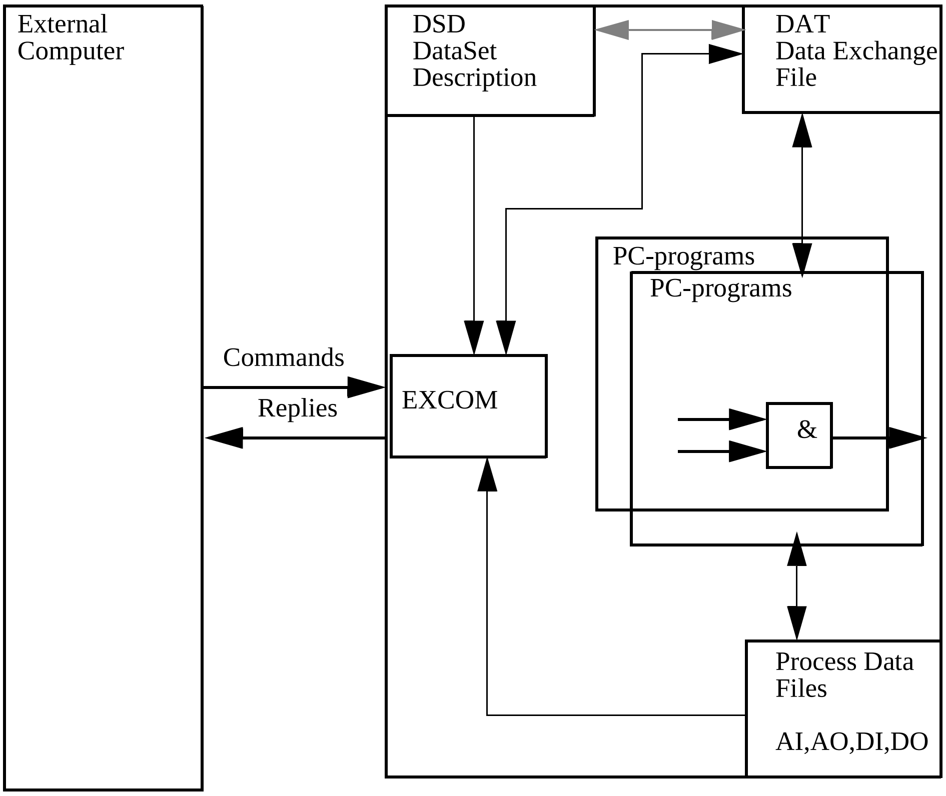


Figure 1-6. Data Flow in the Controller

The external computer has access to the process Data Base and the PC-program data exchange file in the Controller. The process data files are available for read operations only, while the data exchange file is open for write as well as for read operations. The external computer affects the process outputs indirectly via a PC-program. The PC-program always has supreme control of the process.

The data exchange file is accessible by direct reference to individual records and also by reference to Data Sets. A Data Set is a group of associated records in the data exchange file which is referred to by a single reference.

Data Sets are defined locally in the Controller system.

Chapter 2 Installation

2.1 Site Planning Environment

You can store the DSCA 114 communication board and DSTC 120 connection unit in temperatures between -40 and +70 degrees C. They operate at between +5 and +70 degrees C and they have immunity to electrical interference according to SS 4361503, Class 3.

2.2 Setup

2.2.1 MasterPiece 200/1, MasterView 800/1 or MasterGate 230/1

See the following table for the channel utilization for DSCA 114 in MasterPiece 200/1, MasterView 800/1 and MasterGate 230/1 products.

Table 2-1. DSCA 114 Channel Unitization

Channel	MasterPiece 200/1	MasterView 850/1	MasterGate 230/1
CH0	PRINT	PRINT	EXCOM
CH1	EXCOM	PRINT	-
CH2	MV 320	EXCOM	ADLP 10 (GCOM)
CH3	MV 320	EXCOM	ADLP 10 (GCOM)

2.2.1.1 Data Base Element for EXCOM

Fill in the EXCOM communication parameters in the Data Base Element CAP1.2/XCOM_n.

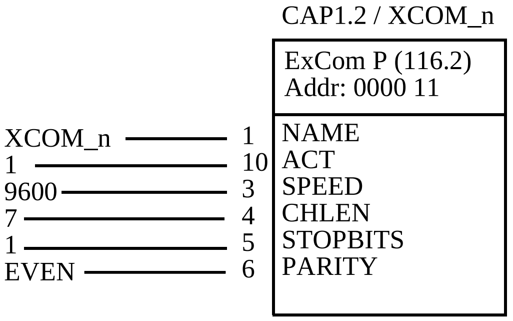


Figure 2-1. EXCOM Data Base Element

You must set the parameters SPEED, STOPBITS and PARITY to fit both the external computer and the DSCA 114.

NOTE

CHLEN (Character length) must always be set to 7 (bits).

The communication is started as soon as you enter the correct values into the Data Base and:

- Answer “**Y**” to the question, “Do you want to activate PRINT/ExCom with these parameters?”,
- Press the **INIT** button to initialize the CPU or
- Give an ECONFIG/DICONFIG command.

Table 2-2. Properties of the XCOM_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
1	NAME	System	XCOM_n(1)	Name of Data Base Element
10	ACT	System/User	0	ACTive 1 = EXCOM restarted after an Init or DICONFIG. Can only be read by AMPL.
3	SPEED	User	1200	DSCA 114 transmission speed 110, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps
4	CHLEN	System	7	Character length always 7 bit/character.
5	STOPBITS	User	1	Number of stopbits can be set to 1, 1.5 or 2.
6	PARITY	User	EVEN	Parity can be set to: NONE, ODD, EVEN, SPACE(0) or MARK (1).

(1).n = 1 or 2

2.2.1.2 DSCA 114 and DSTC 120

The EXCOM communication uses a V.24/RS-232-C channel on the asynchronous communication board DSCA 114 and the connection unit DSTC 120. The ribbon cable to connect the DSCA 114 and the connection unit DSTC 120 is: DSTK 152 for MasterPiece 200/1 and 2639 0410-BY for MasterView 850.

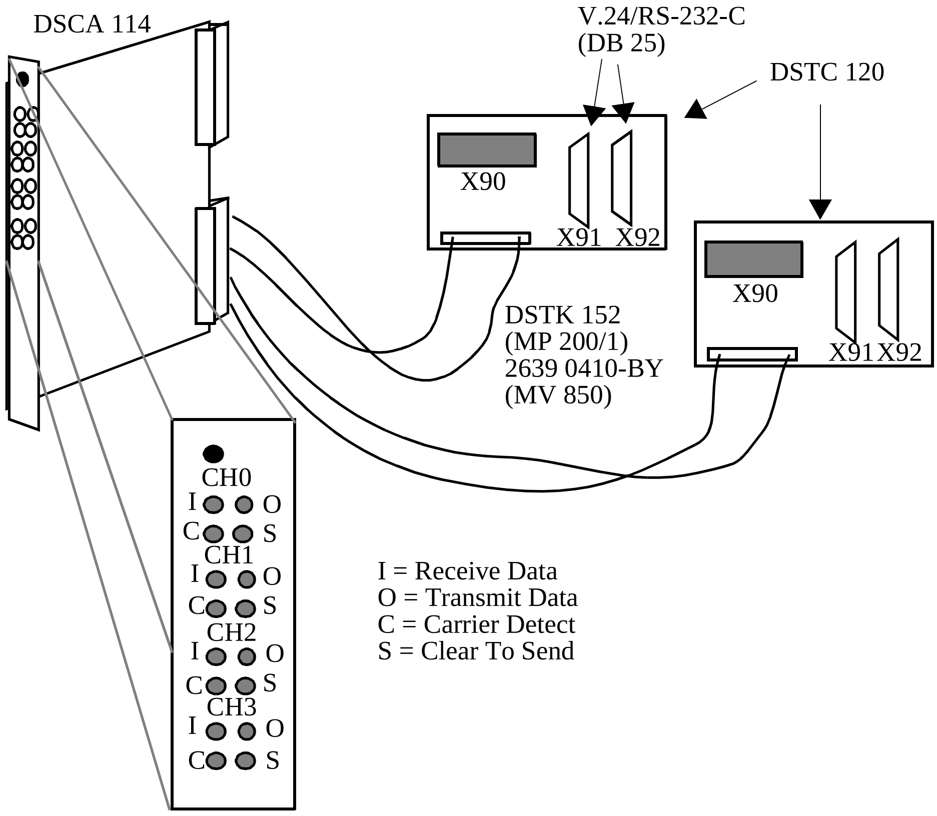


Figure 2-2. EXCOM Hardware in MP 200/1, MV 800 and MG 230/1

Strapping

The strapping of the strap group S1 on DSCA 114 is always set according to Figure 2-3.

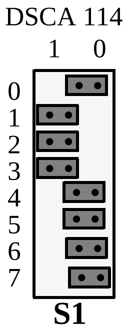


Figure 2-3. Strapping of S1 on DSCA 114

2.2.1.3 Short Distance Modem

When the distance is 15 < L < 300 meters, or if ground potentials differ, between the Master equipment and the external computer, you need a modem. The specification for the DSTC X008 follows:

Table 2-3. DSTC X008 Characteristics

Name	Characteristics
Transmission	Asynchronous, full or half duplex or simplex
DTE Interface	EIA RS-232-C, CCITT V.24/V28, 25-pin D-sub contact according to ISO 2110-1980
Line interface	± 10mA tri-state balanced current loop simplex (one twisted pair) or duplex (two twisted pair) connection
Transmission speed	0 - 38 400 bits/s
Indicators	Power, TD, RD, RTS and DCD
Isolation	Isolation by opto-coupler on incoming line and transformer to line
Isolation voltage	1500 V rms.
Power supply	120/230 VAC ± 10%, 48-62 Hz
Ambient temperature	Operating: 5°-50° C, storage: 5°-70° C
Environmental class	G according to ABB 2098 032

2.2.2 Advant Controller 410

2.2.2.1 Data Base Element for RS-232-C

All of the RS-232-C communication devices are configured via the Data Base Element for CI531.

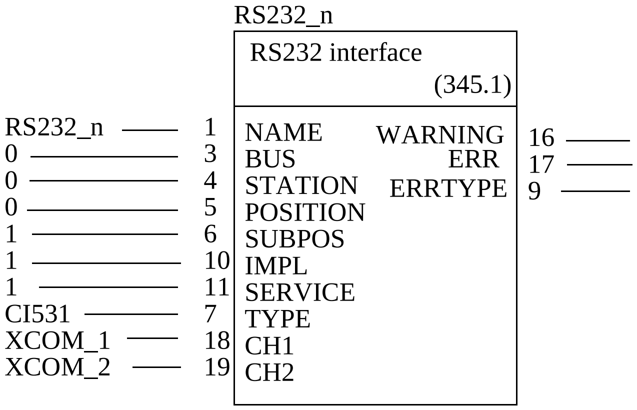


Figure 2-4. Data Base Element for RS-232-C Devices

Table 2-4. Properties for the RS232_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
1	NAME	System	RS232_1	Unique name of Data Base Element
3	BUS	Not applicable	0	Not implemented
4	STATION	Not applicable	0	Not implemented
5	POSITION	System	1	In AC 410, always 1
6	SUBPOSITION	User	1 - 4	The terminal can be modified during configuration mode or during Operation mode if IMLPL = 0.
10	IMPL	User	1	Set to 0 if the submodule is to be removed or rearranged.

Table 2-4. Properties for the RS232_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
11	SERVICE	User	0	This flag is set to TRUE when communication is running and set to FALSE when communication is stopped.
7	TYPE	System	CI531	Default CI531
18	CH1	User	-	Possible strings in **AC 410:** XCOM_1, XCOM_2, TERM_2 or TERM_1 **AC 450**: PRI_01, XCOM_1, XCOM_2, TERM_1, TERM_2, TERM_3 or TERM_4.
19	CH2	User	-	Possible strings in **AC 410:** XCOM_1, XCOM_2, TERM_2 or TERM_1 **AC 450**: PRI_01, XCOM_1, XCOM_2, TERM_1, TERM_2, TERM_3 or TERM_4.
16	WARNING	System	0	Warning flag
17	ERR	System	0	Error flag
9	ERRTYPE	System	0	Error type, see Table 2-5

Table 2-5. Error Codes from RS-232-C Data Base Element.

Type	Code	Interpretation
erbus	31	Module not found or internal bus error
erhwid	32	Incorrect hardware identity on module
erinit	33	Start-up of module failed
erhw	34	Suspected hardware error

Table 2-5. Error Codes from RS-232-C Data Base Element.

Type	Code	Interpretation
erswid	35	Incorrect software identity on module
erifid	36	Incorrect module interface identity
erslvno	50	Illegal slave number
erpositi	51	Illegal module position
erdubpos	52	Module position number already used in the Advant Controller 410/450
erdubslv	53	Two modules have the same slave number

2.2.2.2 Data Base Element for EXCOM

The EXCOM communication parameters are to be filled in the Data Base Element CAP1.2/XCOM_n.

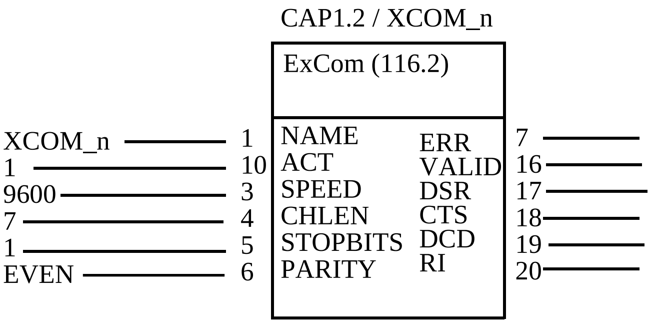


Figure 2-5. EXCOM Data Base Element for AC 410/450

Set the parameters SPEED, STOPBITS and PARITY to fit both the external computer and the CI531.

The state of the RS-232-C circuits (modem signals) DSR (Data Set Ready), CTS (Clear To Send), DCD (Data Carrier Detected) and RI (Ring Indicator) are reflected in the Data Base Element for EXCOM, XCOM_n.

Table 2-6. Properties of the XCOM_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
1	NAME	System	XCOM_n(1)	Name of Data Base Element
10	ACT	System/User	0	ACTive 1 = EXCOM restarted after an Init or DICONFIG. Can only be read by AMPL.
3	SPEED	User	1200	CI531 transmission speed 150, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps DSCA 114 transmission speed 110, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps
4	CHLEN	System	7	Character length always 7 bit/character.
5	STOPBITS	User	1	Number of stopbits can be set to 1, 1.5 or 2.
6	PARITY	User	EVEN	Parity, can be set to: NONE, ODD, EVEN, SPACE(0) or MARK (1).
7	ERR	System	0	Error flag
16	VALID	System	0	Valid flag for modem, the signals below
17	DSR	System	0	Data Set Ready indicator can be 1 or 0.
18	CTS	System	0	Clear To Send indicator can be 1 or 0.
19	DCD	System	0	Data Carrier Detected indicator can be 1 or 0.
20	RI	System	0	Ring Indicator can be 1 or 0.

(1).n = 1 or 2

NOTE

CHLEN (character length) must always be set to 7 (bits).

The communication is started as soon as you enter the correct values into the Data Base and:

- Answer “**Y**” to the question, “Do you want to activate PRINT/ExCom with these parameters?”,
- Press the **INIT** button to initialize the CPU or
- Give an ECONFIG/DICONFIG command.

2.2.2.3 Communication Submodule CI531

The communication submodule CI531 is used for asynchronous RS-232-C/V.24 communication. The module CI531 has got two communication ports with nine-pin D-sub contacts, see Figure 2-6. The Advant Controller 410 uses it for EXCOM communication. You can insert the CI531 into any one of the four submodule slots, see Figure 2-7.

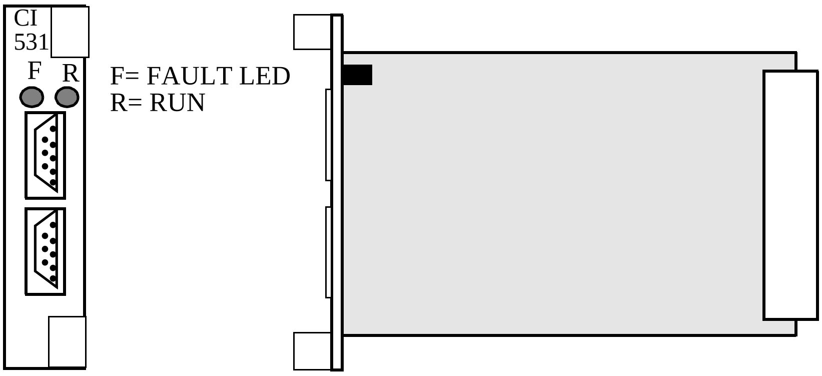


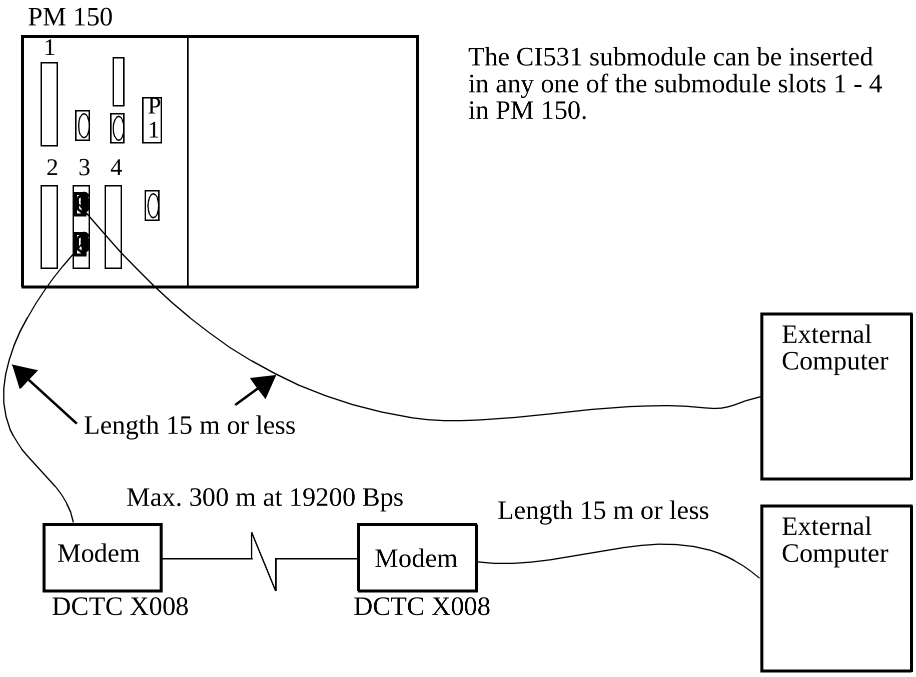
Figure 2-6. CSI531 RS-232-C Submodule

Strappings

There are no strappings for CI531.

RS-232-C indications

The state of the RS-232-C circuits DSR (Data Set Ready), CTS (Clear To Send), DCD (Data Carrier Detected) and RI (Ring Indicator) are reflected in the Data Base Element for EXCOM, XCOM_1 or XCOM_2.



The CI531 submodule can be inserted in any one of the submodule slots 1 - 4 in PM 150.

Figure 2-7. Advant Controller 410

2.2.3 Advant Controller 450

2.2.3.1 Data Base Element for RS-232-C

All of the RS-232-C communication devices are configured via the Data Base Element for CI531. The devices can be of type XCOM_n, PRI_01 or TERM_n.

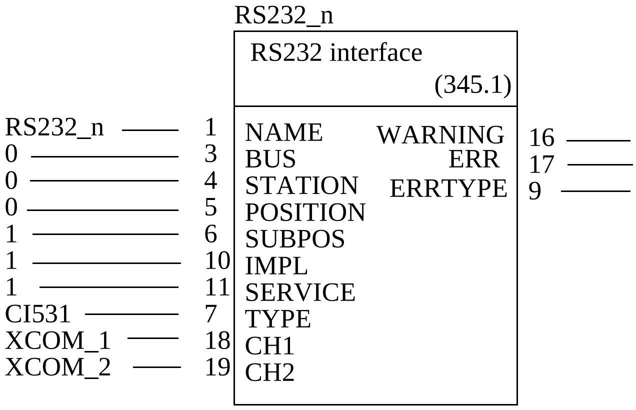


Figure 2-8. Data Base Element for RS-232-C Devices

Table 2-7. Properties for the RS232_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
1	NAME	System	RS232_n	Unique name of Data Base Element
3	BUS	Not applicable	0	Not implemented
4	STATION	Not applicable	0	Not implemented
5	POSITION	User	0	In AC 450 1 - 8
6	SUBPOS	User	1 or 2	The terminal can be modified during configuration mode or during Operation mode if IMLPL = 0.
10	IMPL	User	1	Set to 0 if the submodule is to be removed or rearranged.

Table 2-7. Properties for the RS232_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
11	SERVICE	User	0	This flag is set to TRUE when communication is running and set to FALSE when communication is stopped.
7	TYPE	System	CI531	Default CI531
18	CH1	User	-	Possible strings in **AC 410:** XCOM_1, XCOM_2, TERM_2 or TERM_1 **AC 450**: PRI_01, XCOM_1, XCOM_2, TERM_1, TERM_2, TERM_3 or TERM_4.
19	CH2	User	-	Possible strings in **AC 410:** XCOM_1, XCOM_2, TERM_2 or TERM_1 **AC 450**: PRI_01, XCOM_1, XCOM_2, TERM_1, TERM_2, TERM_3 or TERM_4.
16	WARNING	System	0	Warning flag
17	ERR	System	0	Error flag
9	ERRTYPE	System	0	Error type, see Table 2-5

Table 2-8. Error Codes from RS232_n Data Base Element.

Type	Code	Interpretation
erbus	31	Module not found or internal bus error
erhwid	32	Incorrect hardware identity on module
erinit	33	Start-up of module failed
erhw	34	Suspected hardware error

Table 2-8. Error Codes from RS232_n Data Base Element.

Type	Code	Interpretation
erswid	35	Incorrect software identity on module
erifid	36	Incorrect module interface identity
erslvno	50	Illegal slave number
erpositi	51	Illegal module position
erdubpos	52	Module position number already used in the Advant Controller 410/450
erdubslv	53	Two modules have the same slave number

2.2.3.2 Data Base Element for EXCOM

The EXCOM communication parameters are to be filled in the Data Base Element CAP1.2/XCOM_n.

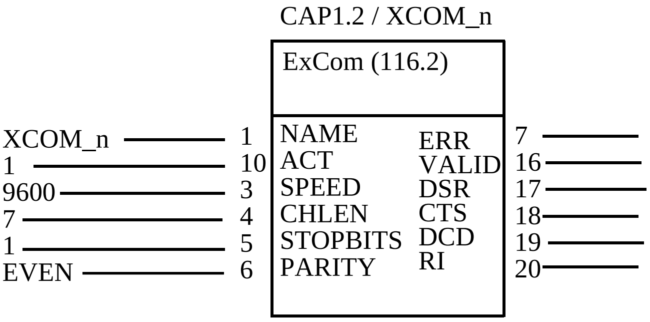


Figure 2-9. EXCOM Data Base Element for AC 410/450

Set the parameters SPEED, STOPBITS and PARITY to fit both the external computer and the CI531.

The state of the RS-232-C circuits DSR (Data Set Ready), CTS (Clear To Send), DCD (Data Carrier Detected) and RI (Ring Indicator) are reflected in the Data Base Element for EXCOM, XCOM_1.

Table 2-9. Properties of the XCOM_n Data Base Element

Terminal no.	Terminal name	Value entered by	Default value	Description
1	NAME	System	XCOM_n(1)	Name of Data Base Element
10	ACT	System/User	0	ACTive 1 = EXCOM restarted after an Init or DICONFIG. Can only be read by AMPL.
3	SPEED	User	1200	CI531 transmission speed 150, 300, 600, 1200, 2400, 4800, 9600 or 19200 bps
4	CHLEN	System	7	Character length always 7 bit/character.
5	STOPBITS	User	1	Number of stopbits can be set to 1, 1.5 or 2.
6	PARITY	User	EVEN	Parity, can be set to: NONE, ODD, EVEN, SPACE(0) or MARK (1).
7	ERR	System	0	Error flag
16	VALID	System	0	Valid flag for modem, the signals below.
17	DSR	System	0	Data Set Ready indicator can be 1 or 0.
18	CTS	System	0	Clear To Send indicator can be 1 or 0.
19	DCD	System	0	Data Carrier Detected indicator can be 1 or 0.
20	RI	System	0	Ring Indicator can be 1 or 0.

(1).n = 1 or 2

NOTE

CHLEN (character length) must always be set to 7 (bits).

The communication is started as soon as you enter the correct values into the Data Base and:

- Answer “**Y**” to the question, “Do you want to activate PRINT/ExCom with these parameters?”,

- Press the **INIT** button to initialize the CPU or
- Give an ECONFIG/DICONFIG command.

2.2.3.3 Communication Submodule CI531

The communication submodule CI531 is used for asynchronous RS-232-C/V.24 communication. The module CI531 has got two communication ports with nine-pin D-sub contacts, see Figure 2-6. The Advant Controller 450 uses it for EXCOM printer or terminal (MV 320) communication. You can insert the CI531 in any one of the submodule carrier boards submodule slots (SC510, SC520 or SC530), see Figure 2-11.

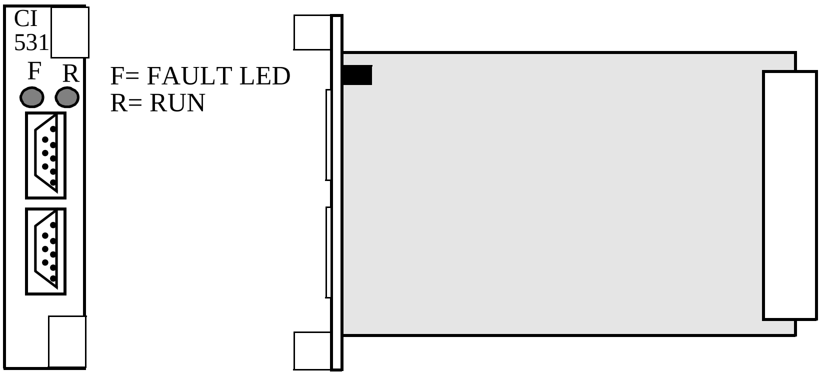


Figure 2-10. CI531 RS-232-C Submodule

Strappings

There are no strappings for CI531.

RS-232-C indictions

The state of the RS-232-C circuits DSR (Data Set Ready), CTS (Clear To Send), DCD (Data Carrier Detected) and RI (Ring Indicator) are reflected in the Data Base Element for EXCOM, XCOM_1.

2.2.3.4 Submodule Carriers

You can insert the CI531 submodule in any slot on any board of type SC510, SC520 or SC530. The CI531 can run two EXCOM channels simultaneously or one XCOM and one PRINT or TERM (MV 320) channel, depending on how you configure the RS232 Data Base Element.

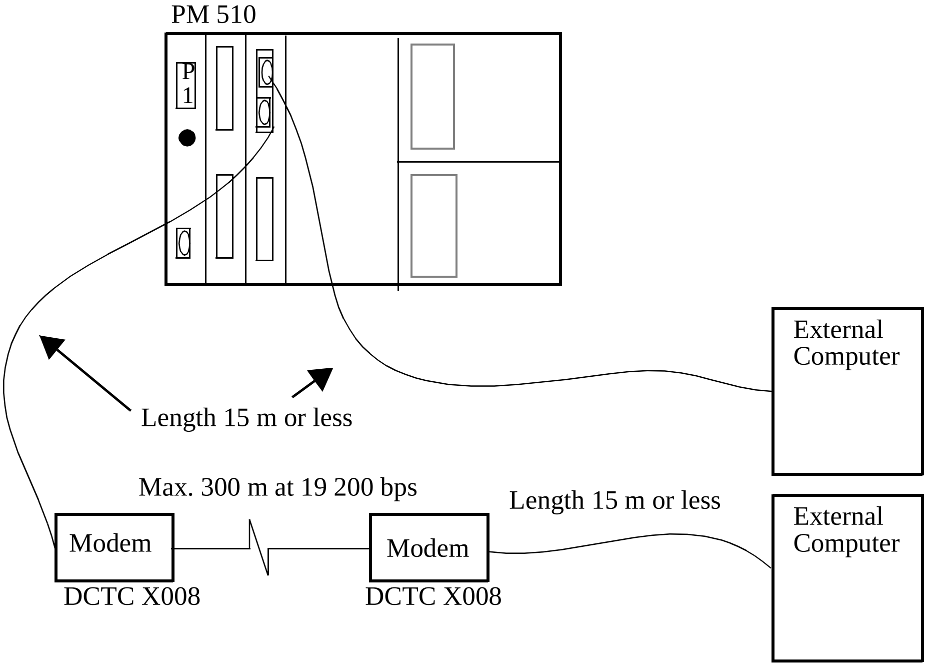


Figure 2-11. MB 300/300E Hardware in AC 450.

2.3 Shutdown Procedures

To stop one (EXCOM) link, set the ACT property in the XCOM_1 or XCOM_2 to zero or false and:

- Answer “**Y**” to the question, “Do you want to activate PRINT/ExCom with these parameters?”,
- Press the **INIT** button to initialize the CPU or
- Give an ECONFIG/DICONFIG command.

Another way to stop both (EXCOM) links on a CI531 is to go into configuration mode and set the IMPL property in the Data Base Element RS232_1 or RS232_2 to zero or false.

2.4 Start-up Procedure

The start-up procedure is as follows:

1. Install the hardware, the CI531 module, and, for the Advant Controller 450, the SC510, SC520 or SC530 boards, in the CPU rack.
2. Make the necessary cable connections with or without a modem.
3. Dimension the Data Base. Note this is done in configuration mode.
4. Configure the Data Base Element XCOM_1 or XCOM_2.
5. Configure the Data Base Element RS232_n.
6. Leave the configuration mode.
7. Verify that there are no error flags set in any of the Data Base Elements mentioned above.

2.5 Product Verification

By checking the Data Base Elements RS232_n and XCOM_1, you can verify the function.

Chapter 3 Configuration/Application Building

3.1 Design Considerations

3.1.1 General

EXCOM provides the basic facilities for external computers to communicate with processes in an ABB Master system. The purpose of the EXCOM function is to perform read/write operations in a Controller data base upon commands issued from an external computer.

This chapter describes the syntax of command and reply messages with respect to format and representation of data. The Controller data base files are described to the extent that they are accessible via EXCOM. Finally, the commands provided by EXCOM and the corresponding reply are presented.

3.1.2 Syntax of Message

A message is composed of two parts: a header and data. Start the message with a Line Feed character and end with a Carriage Return character:

<LF><header><SP><data part><CR>

<CR>   = carriage return

<SP>   = space (blank)

<LF>   = line feed.

The same syntax is used in command messages as in reply messages. The messages can only hold ASCII characters, see Appendix A ASCII Value Table.

NOTE

No lowercase letters are allowed!

3.1.3 Header

The header starts in position 2 of the message, immediately after the <LF>- character. The header has a fixed format of nine characters.

Table 3-1. Header Format

Character Position	Designation	Description
1	direction	‘<‘ indicates command message, i.e., from external computer to MP 200/AC 400. ‘>’ reply message, from MP 200/AC 400 to external computer.
2-3, 4-5	network, node	Network and node numbers, is the address of the MP 200/AC400 station. Legal numbers are ‘00’..’99’. If both network and node = 00, the station directly connected is addressed.
6-7	id	Message identifier, two ASCII characters in the range 20(H) - 5F(H). **This is used as a reply identifier by the external computer**. The identifier given in a command will be returned unchanged in the corresponding reply.
8-9	command	Specifying command ‘TS’ = Translate Symbol ‘RD’ = read ‘WR’ = write
	or	
	condition (in a reply message)	Two uppercase letters indicating the result of a performed command. See each command respectively.

Example

<110317RD The header of a read command to node 3 in the connected network 11.

Message identity = ‘17’

>0202.FOK A reply message from network 2, node 2.

Message identity = ‘.F’

Condition code = ‘OK’.

3.1.4 Data Part

The data part of a message is separated from the header by a space character. It may contain one or several data items separated by space characters. Each data item is of one of the following types:

32 BOOLEANS

The 32 Boolean values are represented by the corresponding hexadecimal value. The range of values is ‘00000000’..’FFFFFFFF’.

EXCOM replies with leading zeroes, but the external computer may omit leading zeroes in commands. The value must always be preceded by a # character.

Example: #F34C34AC’

16 BIT INTEGER

The range of values is -32768 .. +32767, represented by a corresponding set of ASCII digits. EXCOM truncates leading zeroes. Negative values must be preceded with a sign. Positive values may not have a sign.

32 BIT INTEGER

The range of values is -2147483648 .. +2147483647, represented by a corresponding set of ASCII digits. EXCOM truncates leading zeroes. Negative values must be preceded by a sign. Positive values may not have a sign.

32 BIT REAL

The syntax of real values follows the rules for standard Pascal.

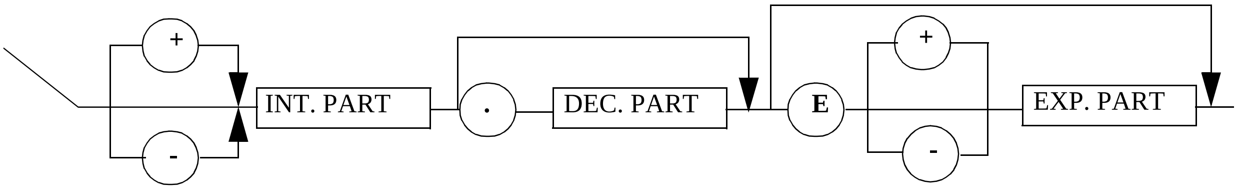


Figure 3-1. Real Value Syntax Rules

The total number of digits in intpart and decpart must not exceed six (i.e., seven characters including a decimal point). The exponent, if present, must not exceed two digits, so the value must always be represented by a maximum of 12 ASCII-characters. The absolute range of value is approximately 1.2E-38 to 9.2E18. Values less than (absolute) 1.2E-38 are truncated to zero. Infinity, Not-a-Number and illegal values are represented with a string of 12 asterisks.

12 BIT STATUS

This format is used to represent status bits in the process signal files.

The 12 bits are converted to a hexadecimal value in ASCII representation. (‘000’ ... ‘FFF’). The value is preceded by a ‘#’ character. Preceding zeroes are not truncated, so the value is represented by a fixed format of four ASCII characters including the ‘#’.

Example ‘#2AC’ which corresponds to the decimal value 684.

3.1.5 Message with Checksum

Normally, error detection is limited to the parity check that is performed on each character by the communication equipment. However, the external computer can increase the message-checking facilities with a checksum control of the message.

To indicate that a checksum is supplied with a command message, the external computer ends the message with the sequence:

&xy<CR>

where xy are two ASCII coded hexadecimal digits representing the checksum.

When EXCOM receives a command message with checksum, it tries to verify the message. If it is correctly received, it is accepted; otherwise, it is ignored.

Reply messages have a checksum when the corresponding command message has one.

The checksum calculation is made as a modulo 256 addition of the numerical (hex-) values of the characters, so the checksum is the eight least significant bits of the total charactersum converted to two hexadecimal digits in ASCII representation. The checksum calculation starts with the first character of the header (i.e., ‘<‘ or ‘>’) and ends with ‘&’.

Example	char	hex
	‘<‘	3C
	‘0’	30
	‘1’	31
	‘0’	30
	‘2’	32
	‘3’	33
	‘3’	33
	‘R’	52
	‘D’	44
	‘ ‘	20 (space)
	‘-’	2D (minus sign)
	‘4’	34
	‘4’	34
	‘&’	26
	sum	2D6
	checksum = D6 (eight least significant bits)	

3.1.6 Data Base Files

Data in a Controller system is organized in files in a data base. The files accessible via EXCOM are:

DAT	PC data exchange file
DSD	DatSet Description file
DI	Digital Input file
DO	Digital Output file
AI	Analog Input file
AO	Analog Output file

The **DAT** file is accessible by **read and write** commands. The process signal files - **DI**, **DO**, **AI** and **AO** are accessible by **read** commands only. The external computer can affect process outputs only indirectly, via the DAT file and PC-programs.

The following paragraphs describe the data base files to the extent that they are accessible via EXCOM.

3.1.6.1 DAT - Data Exchange File

The **DAT** file is used to exchange data between PC-programs within one or several Controller systems. Each record of the DAT file contains one data item representing either 32 Booleans, one 16-bit integer, one 32-bit integer or one 32-bit real. In addition to the value, an identifying text string, a type code specifying the data type and some status information is stored.

DAT is accessible via EXCOM with both read and write commands. Write commands, and reply messages to read commands, contain the value in the data part. The value is represented with the 32-bit Boolean, the 16-bit integer, the 32-bit integer, or the 32-bit real format described in Section 3.1.4, depending on the data type of the value.

You can also access the **DAT** file via **Data Sets**. A Data Set is a group of records in the **DAT** file, defined in a Data Set definition. It can hold up to 24 references to records in the **DAT** file.

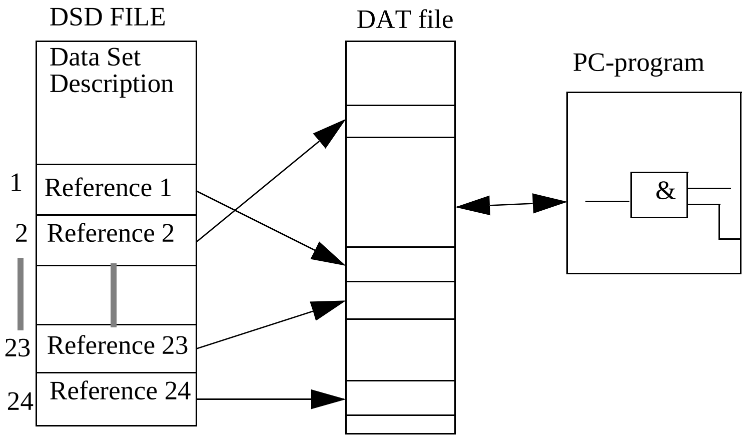


Figure 3-2. Relations between DSD and DAT

Data Sets are defined locally in the Controller systems by means of MasterAid 215, MasterAid 220 or Advant Station 100 Series ES. A Controller can accommodate up to 127 Data Set definitions for use with EXCOM.

When Data Sets are used in read or write operations on the **DAT** file, the order of occurrence of data items in the EXCOM messages is important. This order is determined when the **Data Sets** are defined; it is the same as the order of references from the Data Set definition to the **DAT** file.

A record in the **DAT** file can be valid or not valid. In read operations, and if the **DAT** is not valid, EXCOM treats the record as not accessible. In a successful write operation, EXCOM sets the valid flag equal to true.

A **Data Set** can be enabled and disabled locally within the Controller. When disabled, EXCOM treats the Data Set as if it did not exist and replies with an error message accordingly.

A Data Set Description (DSD) consists of the following properties:

Table 3-2. Data Set Definition Properties

Properties	Remark
NAME	Not used by EXCOM
ACT	TRUE/FALSE
IDENT	Data Set identity (-127..-1 for EXCOM).
NO_BREC	Not used by EXCOM
NO_INT	Not used by EXCOM
NO_INTL	Not used by EXCOM

Table 3-2. Data Set Definition Properties

Properties	Remark
NO-_REAL	Not used by EXCOM
DATA_REF	A consecutive number of references, max. 24, to **DAT** records in the **DAT** file. A list which is not full ends with a zero reference.
USER	= 2 for EXCOM
SOURCE	Not used by EXCOM
VALID	Not used by EXCOM
BLOCKED	Not used by EXCOM
NET	Not used by EXCOM
NODE	Not used by EXCOM
SCAN_FTR	Not used by EXCOM
VALID	Not used by EXCOM

3.1.6.2 DI - Digital Input File

The **DI** file stores information about digital input channels. It is accessible via EXCOM with read commands only. **Data Sets** cannot refer to the **DI** file.

The reply message to a read command referring to the **DI** file contains one data item for each record comprising the signal status and value, represented with the 12-bit status format, see Section 3.1.4. The bits have the following significance:

Table 3-3. Digital Input Description

Bit number	Name in Data Base	Description
B0	ACT	= 1 if the signal is implemented
B1	ERR	= 1 if the signal is erroneous
B2	UPDATED	= 1 if the value is legal
B3	BLOCKED	= 1 if updating is blocked
B4	MAN_ENTR	= 1 if the signal is manually updated
B5	SELECTED	= 1 if the signal is selected for MMC dialog
B6		Reserved for future use
B7		Reserved for future use

Table 3-3. Digital Input Description

Bit number	Name in Data Base	Description
B8	VALUE	= 0 if the value is zero, =1 if the value is one
B9		Reserved for future use
B10	NORM_POS	= 0 if VALUE = 0 is normal, = 1 if VALUE = 1 is normal
B11		Reserved for future use

Bit B8 has the logical state of the input.

3.1.6.3 AI - Analog Input File

The **AI** file stores information about analog input channels. It is accessible via EXCOM with read commands only. Data Sets cannot refer to the **AI** file.

The reply message to a read command referring to the **AI** file contains two data items for each record: the signal status and the value.

The signal status is represented with the 12-bit status format and the value with the 32-bit real format, see Section 3.1.4. The status bits have the following significance:

Table 3-4. Analog Input Description

Bit number	Name in Data Base	Description
B0	ACT	= 1 if the signal is implemented
B1	ERR	= 1 If the signal is erroneous (signal error)
B2	UPDATED	= 1 If the value is updated (legal)
B3	BLOCKED	= 1 if updating is blocked
B4	MAN-ENTR	= 1 if the value is manually updated
B5	SELECTED	= 1 if the signal is selected for MMC dialog
B6		Reserved for future use
B7		Reserved for future use
B8	VALUE > H2	= 1 if value is greater than high limit 2
B9	VALUE > H1	= 1 if value is greater than high limit 1
B10	VALUE < L1	= 1 if value is less than low limit 1
B11	VALUE < L2	= 1 if value is less than low limit 2

3.1.6.4 Analog Output File

The **AO** file stores information about analog output channels. It is accessible via EXCOM with read commands only. Data Sets cannot refer to the **AO** file.

The reply message to a read command referring to the **AO** file contains two data items for each record: the signal status and the value.

The signal status is represented with the 12-bit status format and the value with the 32-bit real format, see Section 3.1.4. The status bits have the following significance:

Table 3-5. Analog Output Description

Bit number	Name in Data Base	Description
B0	ACT	= 1 if the signal is implemented
B1	ERR	= 1 if the signal is erroneous
B2		Reserved for future use
B3	OUTP_BLK	= 1 if the signal is blocked
B4		Reserved for future use
B5	SELECTED	= 1 if the signal is selected for MMC dialog
B6		Reserved for future use
B7	MAN	= 1 if the signal is in manual mode
B8	VALUE = H1	= 1 if the signal has maximum value
B9		Reserved for future use
B10		Reserved for future use
B11	VALUE = LO	=1 if signal has minimal value

3.2 Capacity and Performance

Capacity and performance is largely dependent on the load of the ABB Master Controllers as well as the network.

3.3 Application Start-up

3.3.1 ABB Master Station Address

The ABB Master station address, i.e., the network and node numbers, is specified in the header. See Section 3.1.3.

In command messages, the station address specifies the destination of the message.

In reply messages, the station address specifies the source of the message. The destination of reply messages is always the external computer sending the corresponding command.

3.3.2 File Codes

In commands, files are referenced by file codes. These are:

- DI = 1
- DO = 2
- AI = 3
- AO = 4
- DAT = 5
- DSD = 6

The DSD (Data Set Definition) file may be referenced in Translate Symbol commands, see Section 3.5.1.1

3.3.3 Record Number

Records are identified by numbers in ASCII representation (‘1’..’32767’).

3.3.4 Data Sets

Data Sets are identified by negative numbers in ASCII representation (‘-127’..’-1’).

3.3.5 Symbolic Names

Records in the data base files **DAT**, **DI**, **DO**, **AI** and **AO**, and Data Set definitions in the **DSD** file, are identified by symbolic names. However, for performance reasons, you cannot use these in EXCOM read and write commands. Instead, EXCOM offers a separate command to translate symbolic names into record or Data Set numbers. See Section 3.5.1.1.

3.4 Tutorial

Not applicable.

3.5 Application Procedures

3.5.1 Command and Reply Messages

The following subsections describe the commands and corresponding reply messages provided by EXCOM.

Reply messages can be returned in a different order than the order in which the corresponding commands were sent. You are advised to increase the value of the **message identifier** in the message header of every message you send to ensure recognition of the reply messages.

Commands not recognized or disturbed by transmission errors are ignored by EXCOM. The external computer should have some kind of **time-out supervision** to detect when no reply is received.

3.5.1.1 Translate Symbol

The translate symbol command provides translation of symbolic record names to record numbers.

Command syntax

<LF>header<SP>file<SP>recname<SP>recname<SP>....<CR>

header = nwnnidTS

file = File code, 1..5.

recname = symbolic names of records in the file specified by ‘file’, 1..20 ASCII characters, no blanks.

Reply syntax

<LF>header<SP>recno<SP>recno<SP>....<CR>

header =	nwnnidOK	All is well
	>nwnnidWG	Warning, some record name was not found
	>nwnnidUF	Error, the file is not found
	>nwnnidIC	Error, illegal command

recno = Record number corresponding to record name in command

0 => the record name was not found

If error (UF, IC) no record numbers are returned.

Example

Translate record names ‘TMP5’, ‘UNKNOWN’ and ‘MESV22’ in the AI file (<CR> and <LF> are not shown):

```
Command:        <000078TS 3 TMP5 UNKNOWN MESV22
Reply           >000078WG 63 0 3
```

Checksum characters may be added as described in Section 3.1.5.

NOTE

If you make a Translate Symbol request on a Data Set name, you get the value of IDENT as an answer.

3.5.1.2 Read File

The read file command is used to read single or multiple records in the DAT or process I/O files.

Command syntax

<LF>header<SP>file<SP>recno<SP>recno<SP>....<CR>

header = <nwnnidRD

file = File code, 1..5

recno = Record numbers of desired records.

If preceded by a minus sign, the data item means number of consecutive records, starting with the record specified by the preceding record number.

Reply syntax

<LF>header<SP>data<SP>data<SP>....<CR>

header = >nwnnidOK	All is well
>nwnnidWG	Warning, some record number was not accessible/convertible
>nwnnidUF	Error, the DAT file was not found
>nwnnidOF	Error, too many records specified in command
>nwnnidIC	Error, illegal command

data = Value of desired records, represented according to type and in the order defined by the command

? => data was not accessible

***** = data was not convertible

If error (UF, OF, IC) no data is returned

NOTE

When file is AI or AO, each record is represented with two data items: one carrying the signal status and one carrying the value (see Section 3.1.4). Consequently, if an AI or AO record is not accessible, this is indicated with two question marks separated by a space.

Example

Read from DO file records no 8, 10, 11, 12, 20, 21, 24 (<CR> and <LF> are not shown):

Command:
<112399RD<SP>2<SP>8<SP>10<SP>11<SP>12<SP>20<SP>21<SP>24

Reply: >112399OK<SP>#001<SP>#001<SP>#001<SP>#021<SP>
#001<SP>#001<SP>#101

Checksum characters may be added as described in Section 3.1.5.

3.5.1.3 Read Data Set

The read Data Set command is used to read data from the DAT file by referring to a Data Set.

Command syntax

<LF>header<SP>datasetno<CR>

header = <nwnnidRD

datasetno = Data Set number, -127..-1

Reply syntax

<LF>header<SP>data<SP>data<SP>....<CR>

header = >nwnnidOK All is well
>nwnnidWG Warning, some data was not accessible/convertible
>nwnnidUS Error, the Data Set was not found
>nwnnidUF Error, the DAT file was not found
>nwnnidIC Error, illegal command

data = Values of desired records, represented according to type and in the order defined by the Data Set

? => data was not accessible

***** => data was not convertible

If error (US, UF, IC) no data is returned

Example

Read Data Set 3 (<LF> and <CR> are not shown):

Command: <010182RD<SP>-3

Reply: >010182WG<SP>-11<SP>-1.7834E10<SP>45678<SP>********

Checksum characters may be added as described in Section 3.1.5.

3.5.1.4 Write File

The write file command is used to write data to single or multiple records in the DAT file.

Command syntax

<LF>header<SP>file<SP>recno<SP>data<SP>recno<SP>data<SP>....<CR>

header = <nwnnidWR

file = File code, always = 5

recno = Record number in DAT file

data = Data to be written into record with the preceding record number

Reply syntax

<LF>header<CR>

header = >nwnnidOK All is well

>nwnnidUF Error, the DAT file was not found

>nwnnidIR Error, record does not exist

>nwnnidIF Error, format of some data does not match data type in DAT file

>nwnnidIC Error, illegal command

Example

Write into the DAT file 3.12159 to record 3, 1C to record 77 and 216573 to record 4

(<CR> and <LF> are not shown):

Command:<010133WR<SP>5<SP>3<SP>3.12159<SP>77<SP>
#1C<SP>4<SP>216573

Reply: >010133OK

Checksum characters may be added as described in Section 3.1.5.

3.5.1.5 Write Data Set

The write Data Set command is used to write data to the DAT file by referring to a Data Set.

Command syntax

<LF>header<SP>datasetid<SP>data<SP>data<SP>....<CR>

header = <nwnnidWR

datasetid =Data Set identity, -127..-1

data = Values to be written into DAT file records, represented according to type and in the order defined by the Data Set

Reply syntax

<LF>header<CR>

header = >nwnnidOK All is well

>nwnnidUS Error, the Data Set is not enabled or does not exist

>nwnnidUF Error, the DAT file was not found

>nwnnidIR Error, record referenced from the Data Set does not exist

>nwnnidIF Error, format of some data does not match data type in DAT file, or number of data items does not match Data Set

>nwnnidIC Error, illegal command

Example

Write data to Data Set 112 (<CR> and <LF> are not shown):

Command:

```
<010435WR<SP>112<SP>#0<SP>#0<SP>0<SP>0<SP>0<SP>1.23<SP>0.0
<SP>14
```

Reply: >010435OK

Checksum characters may be added as described in Section 3.1.5.

3.6 Configuration/Application Building Menus

See the appropriate Advant Controller 400 Series User’s Guide for configuration data.

Chapter 4 Runtime Operation

4.1 Product Operation

Not applicable.

4.2 Operating Overview

Not applicable.

4.3 Runtime Tutorial

Not applicable.

4.4 Operating Instructions

Not applicable.

4.5 Runtime Operation Menus

Not applicable.

Chapter 5 Maintenance

5.1 Preventive Maintenance

Not applicable.

5.2 Hardware Indicators

There are two LED indicators on CI531, see Figure 5-1.

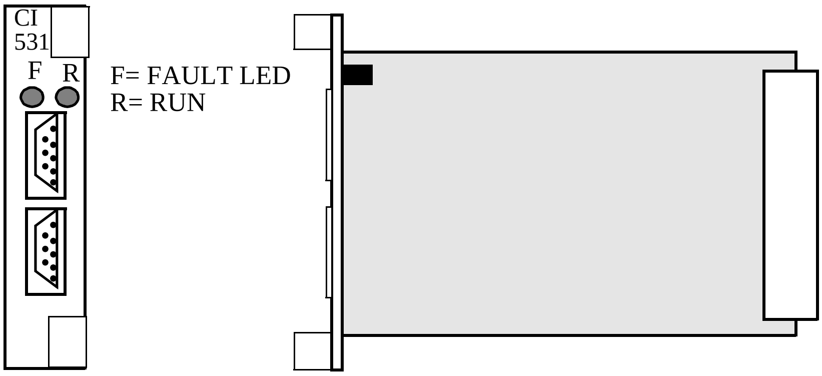
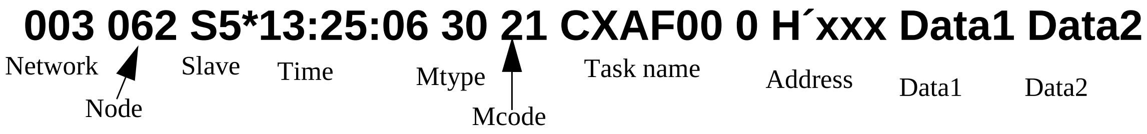


Figure 5-1. Hardware Indicators

5.3 Error Messages

All system messages generated by the EXCOM tasks CXAF000 in the Controller use Mtype 30 in the “standard” ABB Master format, see Figure 5-2.



003 062 S5*13:25:06 30 21 CXAF00 0 H´xxx Data1 Data2

Figure 5-2. System Message

The only system message generated by EXCOM is:

Mtype = 30

Mcode = 21, addressed node unreachable

Data1 = Destination network

Data2 = Destination node

This system message is produced when the EXCOM task does not have contact with the node addressed. This message is only produced the first time the node becomes unreachable.

The messages can be read from the station by connecting a MasterAid 220 or an Advant Station 100 Series ES.

5.3.1 Summary of the EXCOM Protocol Error Handling

EXCOM ignores the command message if any of the following checks is not successful:

- First character is Line Feed
- Message ends with a Carriage Return
- Checksum is correct, if present
- Network and node characters in header are ASCII digits
- Message length is not out of range
- No error indicated from the device handler.

EXCOM generates a reply message with an error status if any of the following checks is not successful:

- Command code must be any of RD, WR, TS
- Write request only allowed to DAT file
- Number of parameters must be in accordance with syntax
- Format of parameters must be in accordance with syntax
- Referenced logical files must exist
- Referenced record must exist (WR commands)
- The records listed in a DataSet must exist and the property ENABLED must be true
- A command must not generate a reply message with a length greater than the maximum message length.

EXCOM generates a reply message with a warning status and error indications if:

- Referenced value is not accessible (RD and TS commands)
- Referenced value is not convertible (RD commands)
- Referenced record is not valid (RD commands).

5.3.2 Flow Control

EXCOM sends XOFF when an internal buffer (127 characters) is almost full and it sends XON when the buffer is empty.

The external computer may send XON when it is ready to receive more data. XON received by EXCOM causes EXCOM to continue its output. XOFF received by EXCOM forces EXCOM to stop its output.

Note that the external computer should supervise its transaction and send an XON if the supervision expires.

5.4 Fault Finding and User Repair

Not applicable.

Appendix A ASCII Value Table

A.1 ASCII Value Table

An ASCII value table follows.

Table A-1. ASCII Table

Hex	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**
0	NUL	DLE	SP	0	É / @	P	é / `	p
1	SOH	DC1	!	1	A	Q	a	q
2	STX	DC2	“	2	B	R	b	r
3	ETX	DC3	#	3	C	S	c	s
4	EOT	DC4	¤ / $	4	D	T	d	t
5	ENQ	NAK	%	5	E	U	e	u
6	ACK	SYN	&	6	F	V	f	v
7	BEL	ETB	‘	7	G	W	g	w
8	BS	CAN	(	8	H	X	h	x
9	HT	EM	)	9	I	Y	i	y
A	LF	SUB	*	:	J	Z	j	z
B	VT	ESC	+	;	K	[/ Ä	k	ä / {
C	FF	FS	,	<	L	\ /Ö	l	ö / |
D	CR	GS	-	=	M	] / Å	m	å / }
E	SO	RS	.	>	N	Ü/^	n	ü / ~
F	SI	US	/	?	O	_	o	DEL

3BSE 003 835R0001

March, 1997